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26. (amended) An optical component manipulation system as described in claim 16, wherein each of the first and second position detection systems comprises an optical encoder and grating.

Remarks:

Claims 1-27 are pending in this application. Claims 1-26 are subject to examination. Claims 5, 16, and 26 have been amended in various particulars as indicated hereinabove to address some minor grammatical/typographical issues.

The only outstanding issues concern the rejection of the claims based on the prior art. The primary reference in each of these rejections is U.S. Pat. No. 4,833,776 to Wakamiya, *et al.* Specifically, claims 1, 2, 4, 9-19, and 24-26 were rejected as being unpatentable over the Wakamiya, *et al.* patent, in view of either U.S. Pat. 6,076,875 to Neff, *et al.* or U.S. Pat. No. 5,562,320 to Bloomberg, *et al.* In a related rejection, claims 3, 5, 20 and 21 were rejected as being unpatentable over the Wakamiya, *et al.*, Neff, *et al.*, or Bloomberg, *et al.* patents in further view of U.S. Pat. No. 5,996,437 to Novak, *et al.* Claims 6, 8, and 22 were additionally rejected based on the Althaus, *et al.* patent, U.S. Pat. No. 5,255,333. Claims 7 and 23 were further rejected in view of U.S. Pat. No. 4,214,353 to Kalina.

Applicants respectfully believe that these claims are patentably distinguishable over the applied references. Specifically, Applicants believe that the invention of claims 1, 16, and 20 would not be obvious, based on the combination of the Wakamiya, *et al.*, Neff, *et al.*, and Bloomberg, *et al.* patents.

Some background might be helpful to understand Applicants' position.

The present invention is directed to an optical component manipulation system. As such, it can be used to align optical components along both the X and Y axes, above an optical bench, for example. To achieve this, it has two jaws for engaging and precisely positioning the optical component.

Each of these jaws has associated X and Y position detectors and actuators. This allows the optical component to be precisely manipulated in the X, Y plane, as is required to align an optical train, including the optical component.

Generally, the applied references are directed to a different problem. That is, the devices of the applied references are used to basically stuff printed circuit boards with electrical components. As such, their principal metric for operation is the robust attachment of those electrical components, down onto the printed circuit boards. This typically involves the insertion of the electrical leads of the components through holes in the circuit board, as described in the Wakamiya, *et al.* patent, for example.

As described in the Wakamiya, *et al.* patent, this functionality achieved by locating the circuit board 5 underneath the finger assemblies 7 and 8. The electrical component, such as the illustrated resistor 1, is then carefully inserted so that its leads pass through the holes 6.

As a result, the vertical position of the resistor must be carefully controlled during the insertion process. Thus, the Wakamiya, *et al.* device can carefully control its position in a direction orthogonal to the plane of the printed circuit board.

The problem addressed by the present invention is profoundly different. Specifically, the location of the optical component in the X, Y plane must be controlled, not simply its insertion into printed circuit board holes. As a result, there are X and Y axis position detection systems and X and Y axis actuators for both the first and second jaws. None of the applied references appreciates this problem. Moreover, none of the applied references has the claimed functionality, which is to control the two jaws in both the X and Y axes.

In summary, it is understood that position detection systems and actuation systems have been known in the prior art. None of the applied references, however, shows a similar configuration in which two jaws are controlled along the X and Y axes with the claimed combination of actuators and position detection systems. This is understandable since none of the applied references appreciates the problem addressed by

the present claimed invention or even its application to the positioning of optical components. Thus, Applicants respectfully believe that the present claimed invention is neither shown, nor suggested, by those references.

Attached hereto is a marked-up version of the changes made to the specification and claims by the instant amendments. The attached appendix, pages 12/17-16/17, is captioned "Version with Markings to Show Changes Made." Please note that due to the amendments, the page and line numbers may be different from the specification as originally filed. Please further note that the page and line numbers hereinabove are relative to the original specification.

Applicants believe that the present application is in condition for allowance. A Notice of Allowance is respectfully solicited. Should any questions arise, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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CLAIMS

What is claimed is:

1. An optical component manipulation system, comprising:

first and second opposed jaws for cooperatively engaging an optical component;

a first x-axis position detection system for detecting an x-axis position of the first jaw;

a first y-axis position detection system for detecting a y-axis position of the first jaw;

a second x-axis position detection system for detecting an x-axis position of the second jaw;

a second y-axis position detection system for detecting a y-axis position of the second jaw;

a first x-axis actuator for positioning the first jaw along the x-axis;

a first y-axis actuator for positioning the first jaw along the y-axis;

a second x-axis actuator for positioning the second jaw along the x-axis; and

a second y-axis actuator for positioning the second jaw along the y-axis.

2. An optical component manipulation system as claimed in claim 1, wherein the first and second jaws are adapted to engage an optical component.

3. An optical component manipulation system as claimed in claim 1, further comprising:

a system frame;

a first air bearing between the second jaw and the system frame; and

a second air bearing between the second jaw and the system frame.

4. An optical component manipulation system as claimed in claim 1, further comprising first and second stages, to which the respective jaws, position detection systems, and actuators are attached.

5. (amended) An optical component manipulation system as claimed in claim 4, wherein each of the stages rides on ~~the~~ a system frame on respective first and second air bearings.

6. An optical component manipulation system as described in claim 1, further comprising a jaw heater for heating at least one of the first and second jaws and thereby an optical component held by the jaws.

7. An optical component manipulation system as described in claim 6, wherein the jaw heating system comprises a laser device that irradiates at least one of the jaws.

8. An optical component manipulation system as described in claim 1, further comprising a jaw heater for heating at least one of the first and second jaws and thereby an optical component held by the jaws to a solder melting temperature.

9. An optical component manipulation system as described in claim 1, further comprising a control system for driving the first x-axis actuator, the first y-axis actuator, the second x-axis actuator, and the second y-axis actuator to position each of the first and second jaws.

10. An optical component manipulation system as described in claim 1, wherein the control system drives the first x-axis actuator, the first y-axis actuator, the second x-axis actuator, and the second y-axis actuator in response to position information from each of the first x-axis position detection system, the first y-axis position detection system, the second x-axis position detection system, and the second y-axis position.

11. An optical component manipulation system as described in claim 1, wherein the jaws extend downward to engage an optical component from above.

12. An optical component manipulation system as claimed in claim 1, further comprising first and second stages, to which the respective jaws are attached, the stages being supported by respective y-axis suspension systems.

13. An optical component manipulation system as described in claim 1, wherein each of the first and second, x- and y-actuators comprises a voice coil system.

14. An optical component manipulation system as described in claim 1, wherein each of the first and second, x- and y-position detection system comprises an optical encoder and grating.

15. An optical component manipulation system as described in claim 1, further comprising a substrate stage for positioning a substrate in a direction that is orthogonal to the x-axis and the y-axis.

16. (amended) An optical component manipulation system, comprising:

first and second opposed jaws for manipulating an optical component;

a first position detection system for detecting a position of the first jaw in two dimensions;

a second position detection system for detecting an position of the second jaw in the two dimensions;

a first actuator for positioning the first jaw in the two dimension;

a second actuator for positioning the second jaw in the two dimensions.

17. An optical component manipulation system as described in claim 16, further comprising a controller for controlling the first and second actuators in response to feedback from the first and second position detection systems.

18. An optical component manipulation system as described in claim 16, further comprising a controller for controlling the first and second actuators to independently position the first and second jaws in response to feedback from the first and second position detection systems.

19. An optical component manipulation system as described in claim 16, further comprising a substrate stage for positioning a substrate in a direction that is orthogonal to the two dimensions.

20. An optical component manipulation system as claimed in claim 16, further comprising:

a system frame;

a first air bearing between the second jaw and the system frame; and

a second air bearing between the second jaw and the system frame.

21. An optical component manipulation system as claimed in claim 20, further comprising first and second stages, to which the respective jaws, position detection systems, and actuators are attached.

22. An optical component manipulation system as described in claim 16, further comprising a jaw heater for heating at least one of the first and second jaws and thereby the optical component held by the jaws.

23. An optical component manipulation system as described in claim 22, wherein the jaw heating system comprises a laser device that irradiates at least one of the jaws.

24. An optical component manipulation system as described in claim 16, wherein the jaws extend downward to engage an optical component from above.

25. An optical component manipulation system as described in claim 16, wherein each of the first and second actuators comprises a voice coil system.

26. (amended) An optical component manipulation system as described in claim 16, wherein each of the first and second position detection systems comprises an optical encoder and grating.

27. An optical structure alignment process, comprising:

engaging the optical structure with a first jaw;

engaging the optical structure with a second jaw;

actuating the first and second jaws to move the optical component along an x- and y-axis to position the optical structure.